CONSERVATION OF SIRENIA

Current Status and Perspectives for Action

by

G. L. C. Bertram

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FOREWORD

In appraising the situation of marine mammals, the Survival Service Commission of IUCN recently drew attention to the greatly depleted status of the Sirenia and decided that considerably more regard should be paid to their conservation. Accordingly the SSC agreed to form a Sirenia Specialist Group and Dr. G.C.L. Bertram of St. John's College, University of Cambridge, U.K., has been appointed as Chairman of the Group.

The Sirenia, like the small Cetacea, suffer from the widespread ignorance which exists about them, based both on their depleted status and their relative invisibility and inaccessibility which renders research difficult.

Wide interest in the Sirenia is growing. It is starting to be recognized that with due care they could be increased in numbers through appropriate conservation action to the stage where they could be again utilized as meat animals and, in the case of the manatee, could be brought to semi-domestication in connection with aquatic weed control in certain tropical fresh waters. Studies that should be initiated on the Sirenia are complementary to those that may be undertaken on the small Cetacea under the auspices of the SSC Whale Specialist Group. The status of small whales has been summarized recently by Dr. Edward Mitchell of Ste-Anne de Bellevue, Canada, in a paper to be issued as IUCN Monograph No. 3.

Dr. Bertram has prepared the present paper to review the conservation status of the Sirenia, both dugongs and manatees, and to examine prospects for conservation action. It will be used as the basis for discussion by the Sirenia Specialist Group in preparing its programme.

IUCN welcomes the general interest being shown in both these groups of marine mammals. The FAO Advisory Committee on Marine Mammals Research, through its Working Party on Marine Mammals, has recently set up a Group on Small Cetaceans and Sirenians to be convened by Dr. Mitchell. The author of the present paper will act as the Group's consultant on Sirenia.

Bibliography

Miss Sandra Husar, working under the auspices of the Smithsonian Institution in Washington, is compiling a definitive bibliography of the modern Sirenia. Dr. Daryl P. Domning of the University of California is extending this to the paleontological literature.

Until the publication of the above bibliographies, the most convenient source of reference is to be found in Bertram & Bertram 1973 (quoted in the Introduction to this paper), together with a few more recent papers under the authorship of D.S. Hartman, G.E. Heinsohn, S. Sikes *et al*.

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I. INTRODUCTION

Taxonomy

The modern Sirenia include three genera, Hydrodamalis, Trichechus and Dugong. The first, consisting of one species, H. gigas or Steller's seacow, was virtually exterminated in the Bering Sea at the end of the eighteenth century: its numbers were small, the individuals huge, and the meat all too attractive to visiting whalers and fur hunters. Trichechus, the manatee, consists of three species:

(a) T. manatus of the tropical Caribbean region from Florida to the Guyanas inhabiting both fresh waters and coastal marine areas;

(b) T. inunguis, the Amazonian manatee, living entirely in fresh water in that great river basin; and

(c) T. senegalensis, the West African manatee, inhabiting the rivers and coastal regions of tropical West Africa.

In contrast the dugong has but one species, Dugong dugon, inhabiting the shallow coastal waters of the Indo-Pacific region from the Solomon Islands in the east to the Red Sea in the west and, most importantly, including northern Australian waters.

It is convenient to refer to the three species of Trichechus as the Caribbean manatee, the Amazonian and the African. The dugong is regarded as one species throughout its huge range.

Status

All these animals (weighing several hundred kilograms each) have been extensively hunted for their meat and are now represented by relict populations with large intervening areas of the original ranges where the animals are now virtually extinct. Northern Australian waters contain the main residual stock of dugongs, with the eastern coasts of Africa being next in importance. Guyana and Belize have moderate numbers of Caribbean manatees, but detailed knowledge of the Central American region and of the West African region is poor. Likewise, for Amazonia detailed information is lacking, but it is certain that commercial killing of the local species of manatee continued even after the Second World War and that numbers now are dangerously depleted. The few (about 1000) Caribbean manatees of Florida have an importance because of their relative visibility which exceeds their significance on grounds of numbers.

The recent publication of "The modern Sirenia: their distribution and status" by G.C.L. Bertram and C.K. Ricardo Bertram (Biological Journal of the Linnean Society, Vol. 5, No. 4, pp. 297-338, December 1973) provides a reasonably up-to-date world-wide background.

Habits

The special significance of the Sirenia resides not only in their intrinsic interest and their now sad rarity, but in the fact that they are the only large mammals which are both fully aquatic and herbivorous, and thereby capable of converting higher aquatic plants, both marine and riverine, to meat. In contrast the hippopotamus feeds largely on land. Now that the Sirenia are so greatly reduced in numbers, huge areas of aquatic higher plants (Thalassia, for example) remain unbrowsed over a wide area of tropical waters. This ecological niche is now empty and unproductive so far as our own species is concerned, whereas rational and managed exploitation of re-built populations of manatees and dugongs could, potentially, be of real value in meat production for man over a wide area. It would be far better that such an incentive should promote human care for the Sirenia, at least in special parts of their range, involving maintenance of stocks at higher levels, than that the Sirenia should become progressively extinct over wider areas through sporadic and improvident hunting by local people.

A special example of their potential usefulness under managed conditions has been touched upon above and will be described in detail below in Section II.1. in connection with aquatic weed control in certain tropical fresh waters where through careful husbandry the manatee might be developed as a further domestic animal.

The smaller Cetacea and the Sirenia alike suffer from their normal invisibility so that their tourist attraction is minimal. However those few manatees which live in clear water, in Silver Springs, Florida, are so much a tourist attraction that they are regularly damaged by the propellers of the boats of speeding pleasure seekers. These manatees now have a locally organized group of conservation-minded "protectors" working on their behalf following the publicity and interest aroused by D.S. Hartman's admirable underwater researches and observations upon them. These manatees are of extreme importance for research on behaviour because of their unique and regular visibility.

There is evidence that in their pristine and unhunted state all the Sirenia were gregarious and that large herds were regular phenomena. Hunting, it seems, induced in the dugong and manatee an extreme wariness and fear of man in many regions. This, combined with actual rarity, makes planned observation virtually impossible in most instances. The study of these animals is therefore one of great difficulty, and "survey", in the sense of visual observation and estimates of numbers, is normally not possible. In most cases the only method of acquiring knowledge depends upon the integration of answers to innumerable questions, asked with diligence and informed care, to local people (in some instances hunters of the species) who in the course of their lives have had the fortune of making repeated chance observations. Thus research is difficult, and this makes certain opportunties to be described below all the more important.

It is also known from experience that manatees in captivity, for example those in the Botanic Gardens in Georgetown, Guyana, can become quiet and docile and may be attracted by audible signals. There is indeed a proper case, both for manatees and dugongs in special instances, to be held in peace in relative confinement for the further necessary education and understanding of tourists and others. Under the right conditions the Sirenia are unafraid of scuba divers.

Protection

In recent years in many countries manatees or dugongs have been placed under new protective legislation. In many cases the legislation is not effectively enforced, but this is at least an advance over the absence of legislation. There are frequently inherent ambiguities in such legislation because Sirenia may or may not be "fish", and manatees live in both fresh and salt waters.

Local efforts for the protection of manatees have been or are now being made in Florida, Guyana, Nigeria and elsewhere, and similar action is being taken for the protection of dugongs in Australia, Sri Lanka, etc. These efforts and their possible extensions are dealt with in Sections II and III. Special literature compilations and bibliographic work is proceeding at the Smithsonian Institution in Washington to encompass the whole of Sirenian literature, and this will provide a useful base for action.

The time is clearly ripe for a new and concerted effort to interest the public in Sirenia and to further protective legislation and their efficient conservation. This may be based initially on places where there is a relative abundance of the animals or where, in fact, such interest is already beginning to express itself in local research and other effort. In the pages which follow examples and special opportunities are particularized.

Movements

Several general aspects require brief explanation in advance. Fortunately, though we are still very ignorant of detail, there is no conclusive evidence of extensive or regular migration either in manatees or dugongs, although we cannot assert that it does not exist. This relative stability of life (if true), with local populations which may be discrete, is a helpful or fortunate feature for Sirenian conservation as a whole.

Hazards

At the same time this is a distinct disadvantage to manatees which are often riverine in habitat, in that they occupy a geographically very narrow environment which may facilitate local hunting. The Amazonian manatee in particular suffers from the danger of enclosure in small areas of more permanent water at times of low river, and this may apply, too, in parts of West Africa. At such times and in such circumstances, local enforcement of protective legislation is difficult and frequently impossible. The dugong does not enter rivers and hence is not subject to such dangers.

An additional hazard is the growth of what may be termed "big-net" fisheries, tropical fisheries using large-meshed nets hanging from the surface as a wall, often down to as much as 20 metres. Such nets in some areas are primarily used to catch the larger fish such as sharks and tuna, but inevitably they are a great menace to all larger vertebrates, Sirenia, turtles and Cetacea alike. Such nets are of tough man-made filaments (nylon, etc.) and even a large dugong can rarely tear its way free. It drowns in the net despite the local legislation intended to protect it. Yet the enlarged, more modern fisheries in deep waters may well seem a proper development in an area of rapid growth of human population needing increased food and protein. Sri Lanka (Ceylon) is a good example of the dilemma described here, and dugongs which are already rare there may well be soon exterminated locally (but see paragraph III.4. below).

Trends

The likely direction in which the Law of the Sea will evolve is hard to discern, but it should be favourable for Sirenia, especially if greater national "ownership" of living resources accrues further from ocean shorelines. Much will depend, of course, upon the degree to which national protective and regulatory legislation can be enforced. There is a fear that, under such new circumstances, those north Pacific nations which possess vigorous far-ranging oceanic fishing fleets may be tempted to concentrate on areas which are now less attractive and which will scarcely be controllable. The waters of northern Australia, the Gulf of Carpentaria and Torres Strait might become particularly vulnerable, and this is where a resurgence of dugong populations is most feasible and probable.

In the sections which follow an attempt is made to indicate particular areas of investigation, legislation and research which are needed for the furtherance of Sirenian conservation everywhere. Such listing can only be indicative rather than complete, but as is indicated under the various headings, certain investigations must be recognized as having the highest priority.

II. MANATEES

Each of the three species of manatee, the Caribbean, the Amazonian and the African, presents its own particular problems in relation to its care and management. There is a central core of ignorance concerning them all, namely whether they do or do not need to move up and down rivers, or between rivers and the sea, for their well-being and for an effective breeding cycle. If they do not, then their protection and potential usefulness will be much eased and enhanced. A personal conclusion from a paucity of evidence is that there is no necessity for distant movements, although this may well often happen. The needs of the three species may differ. To convert ignorance into knowledge with so invisible and now so scarce an animal will require great diligence and considerable financial backing. Some form of radio tracking may provide the way forward but it will be very far from easy. An effective visual system of marking the individual will also be essential.

The breeding cycle, rate of growth, etc., i.e., the general bionomics of the three species of manatee, are likewise as yet almost unknown. The remarkable work of Hartman on the fortunately visible manatees of Silver Springs, Florida, has just begun to indicate probabilities. Evidently both growth and reproduction are indeed rather slow as was long forecast. It is doubtful whether there are now places in the world where manatees are brought ashore for meat with sufficient regularity (whether legally or illegally) to make it feasible to post a skilled investigator to pursue essential investigations of the breeding cycle, etc., and to measure and attempt to determine the age of individuals. The absence of such knowledge which can only be gained in this way will long be an impediment in manatee management and use. Studies of this kind will be essential background tasks for the proposed International Manatee Research Centre (see Section II.i. below). It should be possible to organize the collection of the maximum available data from manatees killed inadvertently in fisheries over a wide area. These tasks are difficult and the needs great.

The manatee, with its capability of consuming large quantities of freshwater aquatic weeds, is an animal of immense potentiality for early direct usefulness to mankind. There has been an extraordinary increase of aquatic weed production in many parts of the world, partly based on the chance introduction of exotic species and partly through run-off from the land of added agricultural fertilizers. Control of the excessive growth in rivers and man-made channels by mechanical means is extremely difficult and expensive, and control by herbicides is biologically dangerous. Both these major methods will long remain essential in many areas, but control by biological means through the use of manatees and various fishes would, in addition, provide much-needed protein for human consumption. Much thought has already been given to the possibility of developing the manatee as a semi-domestic animal for this purpose, but the difficulties involved and the inevitable time factor must not be minimized. Potentiality is undoubtedly there, but to develop practical techniques will demand great effort over decades. Nevertheless, the effort must be made. With this awareness, recent meetings of specialists were held in Guyana, the country where the manatee's potentialities were first recognized (and later re-emphasized by W.H.L. Allsopp in 1960) and where the total residual stock of manatees is probably greatest.

Further effort is needed in the assessment of the present status of residual stocks of all three species of manatee. It is utterly unrealistic to imagine that effective "surveys" or "counts" may be made of this almost entirely invisible animal in the same way as for visible land mammals and birds. Assessment of the local status of an almost invisible aquatic mammal is often a very tedious and time consuming work involving talk with a diversity of people, from fishermen and market inspectors to children who come to school daily by canoe. Direct personal observation will usually be a rare event.

1. International Manatee Research Centre

Following a Workshop on Aquatic Weed Management and Utilization held in Georgetown, Guyana, early in 1973, a specialist Manatee Workshop was organized there in February 1974 under the sponsorship of the National Research Council of Guyana, the National Academy of Sciences (U.S.A.), and the International Development Research Centre (Canada). The final recommendation was, in effect, that an International Manatee Centre should be set up in Georgetown in proximity to the University. This should be a "Centre of Excellence" to be funded internationally by national academies, foundations, etc., and modelled especially upon I.C.I.P.E. (International Centre for Insect Physiology and Ecology now successfully established in Nairobi). The participants possessed expertise over a wide field, as well as real enthusiasm.

The Manatee Centre's objectives would be concerned with the development, through effective husbandry practices over some decades, of the manatee as a semi-domestic animal for purposes of aquatic weed control; with the conservation of manatees everywhere to that long-term end; and with the promotion of detailed laboratory studies over a wide range (e.g., reproduction, nutrition, physiology, etc.) using the evolutionarily highly specialized manatee as the basic research animal; all of this in a setting connected with the University so that local young scientists could train in advanced techniques in a developing country without the need to move to distant centres. The facilities needed would be extensive, including laboratory facilities, confinement facilities in connection with experimental weed control on a substantial scale, and a wild area, preferably a whole riverine drainage basin, for ecological and behavioural studies.

The objectives are excellent, and although some are long-term and some are expensive, the prognosis seems favourable. Professor Amoroso, F.R.S., who now works at the Institute of Animal Physiology at Babraham (near Cambridge, U.K.) was appointed Chairman of the first Steering Committee.

The proposed International Manatee Centre would have no more than a distant and peripheral interest in dugongs, but would endeavour in the long run to deal with the three species of manatees in the manner stated. The potential existence of so admirable a Manatee Centre in no way diminishes the desirability of FAO/IUCN/WWF going ahead in whatever ways may seem expedient, and with special regard to dugong and manatee research on a more local basis wherever it can be developed. Every endeavour should be made for the IUCN Sirenia Specialist Group to build from the beginning close contacts with whatever International Manatee Research Centre may develop, so as to stress the conservational aspects of the Centre. A counter might be needed to the indubitable temptations that will develop to concentrate perhaps too heavily upon detailed laboratory work upon an intriguing new experimental animal!

The monitoring of the movements of individuals by telemetry (radio location, etc.) would be attempted in the wild. There would be important spin-off, too, for the comparable telemetry and marking of dugongs elsewhere. The opportunity would be taken, so it is planned, to organize a collecting system for the carcasses of manatees inadvertently killed in local fisheries. The close confinement research facilities might require perhaps a score of manatees at any one time, but every effort would be made to keep the actual sacrifice of animals to an absolute minimum. The manatee husbandry and weed control experiments would require larger numbers of manatees. All these animals would have to be taken locally from the wild stock (though a few individuals of the other species might be imported at a later date). To this end, superior catching and transport facilities would be evolved. It is believed that the collection of manatees in the numbers required is feasible from the rivers of Guyana, and could be accomplished without permanent detriment to the residual stock. Already existing legislation must be successfully enforced despite a rapidly growing and meat hungry local population, whose national interest and pride in the manatee needs to be raised to a high level.

2. Caribbean Manatee

Much further investigation in detail should be made over a period as to the status of local populations and the existence of protective legislation over the whole of this species' range. The general picture is one of extreme rarity now over the Caribbean Islands area; a small but locally notable population in Florida; a fair residual population in Guyana (probably the largest remaining population anywhere); a probably more dense population in Belize, though the total area is small; a moderate population in Surinam; elsewhere in the Central American States there is a regrettable shortage of information apart from odd records of continuing presence. "Survey" of the status in these various places would seem now mostly a matter for correspondence with selected and newly enthused, knowledgeable individuals locally and integration of their replies.

A stimulation of such local activity by IUCN and the proposed International Manatee Research Centre jointly would seem sensible. Such "survey" might still disclose particular discrete manatee populations capable of proper protection locally enforceable.

3. Amazonian Manatee

There seems to be general agreement that the Amazonian manatee, once so abundant over a large part of the whole Amazon Basin (both in Brazil itself and in the confluent tributaries in Peru, Colombia and Venezuela) is now almost everywhere in desperate straits. The populations are greatly reduced, local hunting pressures persist as commercial pressures are superseded, and protective legislation is seemingly unenforceable. There are no known sanctuaries where real protection is afforded. The difficulties of protection and enforcement over so large an area are likewise to be recognized. The provision of sanctuaries must have high priority: there is no published evidence (it is believed) that the Amazonian manatee is other than fairly stationary in behaviour and, if so, that should facilitate care and population increase by the imposition of reserves by the national authorities concerned.

It is to be hoped that the influence of the proposed International Manatee Research Centre to be set up in Guyana will have an effective stimulatory effect upon the local authorities. Earlier effort is needed, and it will not be enough to rely upon the repercussions of a Centre which will inevitably take several years to become effective. That effort should include not only "survey" of the type already described, but should cover a series of visits by an "expert" versed in South American ways, linguistically and otherwise, who could stimulate and enthuse the cognoscenti to set pen to paper in a huge area where foreign correspondence seems, to the outsider, to be regrettably neglected! Are there places where commercial hunting still continues or where residual populations could enforceably be protected?

4. West African Manatee

The primitive distribution of the manatee in West Africa was wide, both along the coasts and even far up the rivers. Recent detailed knowledge of their local distribution and numbers in the countries concerned is scanty, but the main conclusion must be that numbers are now in general small (if not already extinct in many of its past haunts) and that hunting pressures remain high despite a variety of mostly unenforceable legislation.

The only research and effort (known to the present author and currently in progress) is that of Dr. Sylvia Sikes, who is Consultant Zoologist (Wildlife), Benue-Plateau State, Nigeria (and is a Senior Research Fellow of the University of Ibadan). The local difficulties are great. So little is now known of the manatee because of its present rarity, that the education of some officials by demonstration of manatees in captivity seems essential to arouse local enthusiasm and effort. This requirement for some conservation projects seems to warrant further enquiry and acceptance.

Indubitably an effort on behalf of manatees in West Africa is essential. It should include, if possible, both the local effort in the Benue River (protection, translocation, etc.) and a wider "survey" throughout West Africa.

III. DUGONGS

The world's dugongs are, in one sense, more favourably placed than the manatees which are often so vulnerable because of the constrictions of their riverine habitat. Even so, dugongs are now rare animals in large parts of their extensive range, approaching extinction if they have not gone already. In such areas sporadic fishing (even if not directly intentional) continues, and the populations certainly have little chance to rebuild. The Red Sea, the Gulfs of Arabia and Persia, and Sri Lanka are examples.

The dugong, from the point of view of long-term usefulness to man, must be regarded as a potentially important meat mammal over a wide area, but it lacks the manatee's additional (and immediately more important) potential for purposes of weed clearance in confined water-ways. The total of dugongs in the world, both original, present and in a better future, must, however, be looked upon as probably much larger than the corresponding world totals for manatees.

1. Australian Dugongs

In its northern waters Australia possesses by far the largest residual stock of dugongs. It is not an unreasonable supposition that they are now, in some areas, beginning to rebuild their population in peace and under protective legislation. That legislation permits aborigines, traditionally dependent upon dugong hunting, to continue their activity, but its intensity seems to be diminishing under pressures for these people to acquire a more land-based economy. The range of research opportunities open to biologists in Australia is so vast that in fact dugongs have in general been long neglected, although a heightening of interest is now beginning. Two particular activities seem the most pressing, and these might well be organized from the James Cook University in Townsville, Queensland, where Dr. George Heinsohn is active and publishing papers.

(i) Population survey: The effort made by Bertram and Bertram in 1965 to investigate dugong distribution, though continued by a deal of correspondence (and published in 1973) must now be to a degree outmoded, and it was inevitably incomplete. A new and continuing survey is essential, and it should be based on Australian expertise, opportunity and effort. Again, inevitably, the survey might be largely a matter of integration and judgement of hearsay information gathered over a very wide field and in great detail by both visits and correspondence. Additionally, there should be special visual investigations of selected areas from the air with the support of military or other governmental facilities (e.g., Shoal Water Bay Military Training Area, where all fishing and other disturbances are said to have been excluded; Princess Charlotte and Ninian Bays, which are remote, but seemingly with rather plentiful dugongs when visited by the research vessel *Alpha Helix* in 1966).

Aerial survey (i.e., sightings from light aircraft) for dugongs and other large vertebrates has considerable attraction and real potential, but is expensive in both time and money and is frequently disappointing. Whatever is seen provides proof of local survival and a minimal figure for presence, but absence of sightings is far from being proof of absence of animals.

(ii) Use of carcasses: The opportunity remains wide open for competent but tough young biologists to live at various aboriginal settlements where several dozen, if not several hundred, dugong carcasses are brought ashore annually, and legally, by the local hunters. The settlements (in the Cape York and Carpentaria regions) are mostly missionary establishments and the help of the missionary societies would be invaluable. (Bertram and Bertram 1973 quote the help and figures provided from Numbulwar Station, Rose River.)

With ample fresh material available for inspection, measurement and the selection of anatomical material, much could be learnt quite quickly. This is the only opportunity available anywhere in the world for this type of work and it ought to be seized swiftly, for this traditional, and legal, dugong hunting is now on the decline. Again this is an opportunity primarily for Australian initiative and vigour. Several pairs of biologists in scattered localities might seem the most efficient approach. Much, too, could be learnt of hunting techniques and, hopefully, of the detailed movements, nutrition and behaviour of the animals. This would be very suitable work for Ph.D. students, and need not be costly

(iii) Dugong taken in shark netting in Australia: Queensland for a dozen years has had a programme, in operation at several places but notably Magnetic Island, of attempting to reduce local shark populations for the well-being of human swimmers. The method does not use permanent set nets, as in Natal and elsewhere, to physically exclude the larger sharks, but instead involves nets and baits set day by day to catch sharks and so reduce the local population. The system is evidently effective to judge by the catch records. Unfortunately in addition to sharks, numbers of dugongs and turtles are accidentally taken and the local population of the former, at any rate, seems to be reduced. The dugongs are normally drowned and few are left to be released as still living.

The availability of the dugong measurements and carcasses has served some biological usefulness, notably for the Bertrams in 1965, and Heinsohn in certain succeeding years at Magnetic Island.

There might seem to be a case now for the Queensland Government to reassess the netting programme and perhaps rely upon baited hooks (drum-lines). Further, there may be a need to investigate in greater detail the inadvertent loss of dugongs in commercial fisheries in northern Australian waters.

2. Somalia: Special Opportunity and Project

The only recent account of dugongs in large, tame, unhunted herds is on the 1000 mile stretch of the southeast-facing sea coast of Somalia. It is highly desirable that this be investigated and the herds be assured of a protected future and early study if they indeed still exist.

The record comes from W. Travis in his book "The Voice of the Turtle" (1967 pp. 173-5):

> "So I decided to 'herd' these great aquatic browsers, to turn them south out of our area, and for the next ten days two boats were deployed on this task. During this time I learnt much concerning their lives, most of which was at complete variance with what I had read. Many authorities regard the dugong as an inhabitant of swamp and estuary, shunning the open sea and existing only in backwaters and in small family groups. Yet here, off the open coast, with the nearest swamp 300 miles to the south, I found huge herds, sometimes as many as 500 strong, swimming freely within and without the reef. They were neither elusive nor shy; being great dumb sea-oxen that only responded when you whacked their backs with a paddle, blew conch-shell horns, or clapped the water with oarblades. During the afternoon the young calves of up to 4 feet long would leave the herd and form a nursery close to the sandy beaches. Here they would play like slow, clumsy puppies. Wading amongst them, they would dive between my legs, brush against my side and generally use me as pivot point and scratching post."
>
> "By the end of ten days I had succeeded in moving the 'flocks' of dugong some fifteen miles to the south and this we reckoned was far enough for the time being."

Personal discussion with Travis in 1973 gave further assurance of the veracity of the observations. It also elicited a further understanding of the difficulties of travel and study on that coast.

The difficulties of an investigation are great. The coast is hot, dry and rugged, little inhabited, and the tracks are mostly a dozen miles inland and often separated from the coast by dunes. There are few fishermen and anchorages are scarce, and the region is one of steady on-shore trade winds for much of the year. However, there is some sheltered water behind reefs and off-lying islands. It is a difficult country for strangers. There may also be dugongs along the northern coasts of Somalia, but of this we have no recent records at all.

To attempt to mount a full scale maritime survey, with a vessel coasting and visiting anchorages one by one, would probably be unjustified in the first instance through excessive cost. But a preliminary survey from a light aircraft might be feasible. A positive result would encourage further investigation, while a negative result would not necessarily be meaningful or decisive. Suitable flying days for careful visual observation are likely to be few.

The first stretch of coast to be thus surveyed might be the 250 mile (approx.) stretch between the Kenya border (near Lamu) and Mogadishu, the capital of Somalia, and having special attention paid to the region of the Bajuni Islands (just south of Kismayu and the equator). Travis also saw herds 500 miles further northeast up the Horn of Africa, but that region would probably be even more difficult to investigate. A first attempt on the southern region might well open the way later to the north.

3. Dugongs in Indonesia

The presence or absence, survival or near extinction, of the dugong in the whole of the Indonesian Archipelago is more poorly known than anywhere else in its range, at least in western language scientific literature. At a guess the animal survives in small numbers over a wide area but we know nothing whatever in detail.

There is early need to stimulate local biologists, or the staff of some suitable marine research station, to mount a question and answer survey to provide, within a reasonably short time, at least a minimal picture of the present status of the species.

4. Reserves for Dugongs

The usefulness of legally enforceable havens for dugongs cannot be asserted with confidence because of the paucity of evidence as to the natural movements (or migrations) of the species. There is no firm evidence of regular movements on any substantial scale, though certainly in a wide variety of places herds have been seen to move together in one direction. Further, the distribution of dugongs over the western Pacific Islands could scarcely have occurred in the absence of occasional wandering over long distances of deep water.

But insofar as undisturbed dugongs are relatively stable in their habits, peaceful havens might be of great advantage to the species locally so long as poaching is truly controlled.

A particular and promising example is provided by Sri Lanka (Ceylon), where there are thoughts of extending the Wilpattu National Park on the west coast to include the adjacent Dutch and Portugal Bay areas with especial regard to the protection of dugongs. The dugongs of Sri Lanka are rapidly nearing extermination, especially through the inevitable repercussions of an expanding large-net fishery which inevitably drowns all large air-breathing animals (i.e., smaller Cetacea, dugongs and turtles) which chance to come in contact with it. If large-net fishery (and preferably other fishery as well) could be kept out of the area in question, then there is a real possibility (but not a certainty) that a residual population of dugongs might survive or even flourish there.

IV. SUMMARY OF ACTION REQUIREMENTS

This summary sets out early desirable actions, but not priorities since the several needs are by no means competitive.

1. The proposed International Manatee Research Centre in Guyana should be encouraged in all available ways. But, so far as IUCN is concerned, special attention should be paid to two of the Centre's several aims, namely (a) the spread of conservational effort particularly in the Caribbean region and in the Amazon and (b) the attempt to further the semi-domestication of the manatee for its potential in the control of freshwater aquatic vegetation. This is primarily an organizational effort.

2. Zoologists and others in the Amazon region should be encouraged to make new attempts to define the present status and distribution of the Amazonian Manatee, and governments must be urged to set up effective sanctuaries. The problem is mainly in the realms of organization and law enforcement.

3. The same need applies to the West African Manatee and the persons responsible and interested in West Africa. The active work already in progress in Nigeria is worthy of further encouragement.

4. Australia is the key area for Dugongs and three particular items need special attention:

    (a) detailed investigation of the carcasses of animals legally taken at certain northern stations;

    (b) "survey" by aerial and other means towards a further assessment of the status and distribution of the species; and

    (c) a new assessment of the shark-netting programme (and indeed other fisheries) in relation to inadvertent damage to large non-shark vertebrates.

5. A detailed investigation of the status of Dugongs should be carried out on the coasts of Somalia where large herds may still exist.

6. Ignorance of the status of Dugongs in Indonesia needs to be corrected by enquiry, undertaken by correspondence in the first instance.

7. The promotion of Marine Parks or reserves to include residual Dugong populations needs further encouragement.

The International Union for Conservation of Nature and Natural Resources (IUCN) is an independent international body, formed in 1948, which has its headquarters in Morges, Switzerland. It is a Union of sovereign states, government agencies and non-governmental organizations concerned with the initiation and promotion of scientifically-based action that will ensure perpetuation of the living world - man's natural environment - and the natural resources on which all living things depend, not only for their intrinsic cultural or scientific values, but also for the long-term economic and social welfare of mankind.

This objective can be achieved through active conservation programmes for the wise use of natural resources in areas where the flora and fauna are of particular importance and where the landscape is especially beautiful or striking, or of historical, cultural or scientific significance. IUCN believes that its aims can be achieved most effectively by international effort in co-operation with other international agencies, such as Unesco and FAO.

The World Wildlife Fund (WWF) is an international charitable organization dedicated to saving the world's wildlife and wild places, carrying out the wide variety of programmes and actions that this entails. WWF was established in 1961 under Swiss law, with headquarters also in Morges.

Since 1961, IUCN has enjoyed a symbiotic relationship with its sister organization, the World Wildlife Fund, with which it works closely throughout the world on projects of mutual interest. IUCN and WWF now jointly operate the various projects originated by, or submitted to them.

The projects cover a very wide range, from education, ecological studies and surveys, to the establishment and management of areas as national parks and reserves and emergency programmes for the safeguarding of animal and plant species threatened with extinction as well as support for certain key international conservation bodies.

WWF fund-raising and publicity activities are mainly carried out by National Appeals in a number of countries, and its international governing body is made up of prominent personalities in many fields.

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